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SuperNEMO in the USA

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On behalf of the SuperNEMO Collaboration

The first module of the SuperNEMO experiment is currently under construction in the Modane Underground Laboratory in the Fréjus Tunnel under the Alps. SuperNEMO will have 20 such modules and is building on the extensive experience of the NEMO-3 experiment which operated from 2002 to 2011. NEMO-3 measured half-lives for two-neutrino double beta decays ($2\nu\beta\beta$) and set some of the most stringent constraints for neutrinoless double beta decay ($0\nu\beta\beta$) for seven isotopes, the flagship ^{100}Mo, shown in Fig. 1, and also ^{48}Ca, ^{82}Se, ^{96}Zr, ^{116}Cd, ^{130}Te, and ^{150}Nd.

The NEMO-3 experiment employed isotopic foils surrounded by a wire drift chamber for 3D tracking in a 25 G magnetic field and large scintillator blocks to measure electron energy. The detector allowed to reconstruct the topology, energy, and timing features of events. This technique delivers several observables for each event, providing a powerful means to identify double beta decays and to reject background events. SuperNEMO will further exploit the NEMO-3 technique and will have significantly improved sensitivity by reducing backgrounds by two orders of magnitude and improving the calorimeter energy resolution by a factor of two. The goal of SuperNEMO is to employ 100 kg of ^{82}Se to probe the half-life for $0\nu\beta\beta$ at the level of 1×10^{26} y in a 500 kg-year exposure, corresponding to the effective neutrino mass $\langle m_{\beta\beta} \rangle$ in the 50 meV range.

The NEMO technique offers unique experimental signatures of double beta decays that can be applied for any isotope, unlike most other techniques used in searches for $0\nu\beta\beta$. This particle-physics-like approach requires relatively large detector volume per unit of isotopic mass but provides complete kinematical reconstruction of two electrons in the final state. These virtues allow to envision that more modules could be constructed in other underground labs around the world. *This brief statement merely points out that laboratories considered for the Intensity Frontier program may present attractive opportunities for cost-effective deployment of SuperNEMO modules with different isotopes.*

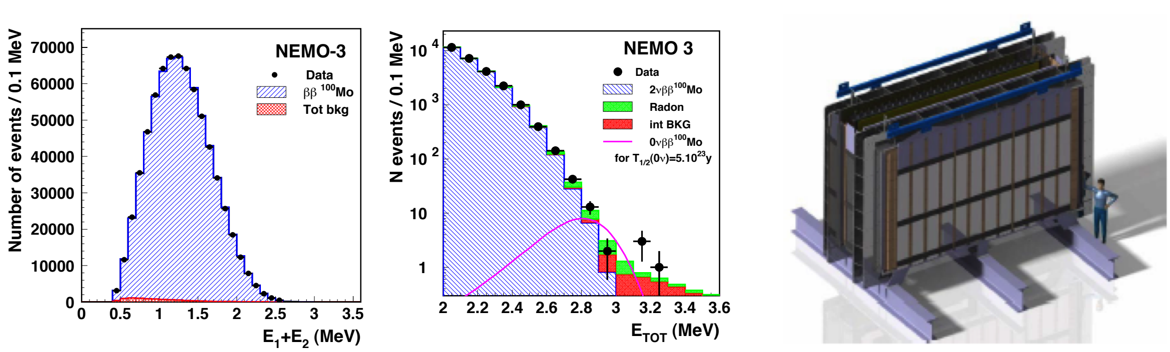

Figure 1: NEMO-3 "flagship" measurement of $0\nu\beta\beta$ and $2\nu\beta\beta$ for ^{100}Mo. The left plot shows the energy distribution of two electrons in more than 700,000 candidate $2\nu\beta\beta$ events, the middle plot shows a zoomed-in plot on the left near the end-point or transition energy of 3.034 MeV. For the ^{100}Mo foil, the background for $2\nu\beta\beta$ is almost negligible. A Monte Carlo simulation of $0\nu\beta\beta$ shown as a pink line is for a hypothetical $T^{0\nu}_{1/2} = 5 \times 10^{23}$ y. The right plot shows a SuperNEMO module.